Simulation in New Zealand: what have you done for me lately? New Zealand Association for Simulation in Healthcare (NZASH) white paper

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ABSTRACT

Medical simulation has become an integral aspect of modern healthcare education and practice. It has evolved to become an essential aspect of teaching core concepts and skills, common and rare presentations, algorithms and protocols, communication, interpersonal and teamworking skills and testing new equipment and systems. Simulation-based learning (SBL) is useful for the novice to the senior clinician. Healthcare is a complex adaptive system built from very large numbers of mutually interacting subunits (e.g., different professions, departments, equipment). These subunits generate multiple repeated interactions that have the potential to result in rich, collective behaviour that feeds back into the organisation. There is a unique opportunity in New Zealand with the formation of Te Whatu Ora – Health New Zealand and Te Aka Whai Ora – Māori Health Authority and the reorganisation of the healthcare system. This viewpoint is a white paper for the integration of SBL into our healthcare system. We describe our concerns in the current system and list our current capabilities. The way SBL could be implemented in pre- and post-registration phases of practice are explored as well as the integration of communication and culture. Interprofessional education has been shown to improve outcomes and is best done with an interprofessional simulation curriculum. We describe ways that simulation is currently used in our system and describe other uses such as quality improvement, safety and systems engineering and integration. The aim of this viewpoint is to alert Te Whatu Ora and Te Aka Whai Ora of the existing infrastructure of the simulation community in New Zealand and encourage them to invest in its future.

As the 2023 Rugby World Cup kicked off, most Kiwis hoped for a strong performance from the All Blacks. While many had faith in the experiences and skills of the players, it was also taken for granted that the players received expert coaching, performance feedback and team training. We also accepted (almost) that their performance may not always meet expectations. We need to employ the same realistic expectations of healthcare, as the delivery of healthcare is far more complex than playing a team sport. It demands that individuals engage in multiple complex interactions with one another, while demonstrating proficiency with information technology and medical equipment across various healthcare settings. Healthcare professionals fulfil these diverse roles as they collaborate to address the needs of multiple patients within the complex socio-technical healthcare system, and it is time to recognise the need to empower them for success.

Simulation is a term with a broad definition that can be summarised as "*A technique that is designed to 'imitate' the operation of an* ***existing*** *familiar or* ***proposed*** *unfamiliar systems*." Simulation has been fully integrated into industries such as nuclear power production, military and commercial aviation (high reliability organisations that have a very low failure rate considering their inherent risks).[1] These organisations would not consider functioning without it—indeed, we fly with Air New Zealand because we have confidence that their pilots have practised emergency situations and have received debriefings on their communication and teamwork in these simulated scenarios. Simulation-based learning (SBL) in healthcare is an educational method with a substantial evidence base for its use in a wide range of situations. For example, preparing for real clinical situations, practising for rare events, practising or testing algorithms, developing teamwork and communication skills, learning to master technical skills and testing systems.

Perhaps most significant is the opportunity to practise without patient risk.

In New Zealand, we are privileged to have

the opportunity to fully integrate our bicultural heritage into healthcare with the newly created Te Whatu Ora – Health New Zealand and Te Aka Whai Ora – Māori Health Authority. Their stated kaupapa includes embracing partnership, collaboration and community partnerships to celebrate health and wellbeing. In support of this, and building on the work of others, simulation needs to be embedded into healthcare.[2] The development of robust simulation curricula would empower our own healthcare community to improve their competence, confidence and wellbeing to breakdown cultural and equity barriers. This is likely to contribute to employee wellbeing and culture with improved recruitment and retention facilitating the ability of staff to deliver in line with Te Tiriti o Waitangi and Te Aka Whai Ora's kaupapa.[3,4]

Our concerns

Currently, New Zealand's healthcare system possesses the foundational infrastructure for high-quality simulation and in some places there are examples of gold-standard practice. Although there is an existing infrastructure of personnel and equipment (as shown in Table 1), we are still some way from establishing a nationally agreed-upon simulation-based framework among tertiary organisations and professional colleges. The integration of SBL into undergraduate, graduate and postgraduate education for healthcare professionals is crucial. Equally essential is the recognition that interprofessional education (IPE) is foundational for ensuring that healthcare professionals share a common language, possess a clear understanding of their roles and can foster high-quality teamwork.[5,6] Tertiary organisations should also foster stronger collaboration with healthcare providers at the practical level to reduce the gap between being a student and being a professional. The healthcare system has historically left most clinical training to a relatively informal apprenticeship process that relies on expert colleagues sharing their own knowledge and skills while also providing the service to patients. Unfortunately, there are two main concerns with this: the first is that workload is increasing clinicians' cognitive load and, consequently, facilitating learning falls away; the second is that the emphasis is on individual knowledge and skill rather than on the performance of clinical teams. We need to re-establish a community of practice among healthcare workers and break down barriers between specialties that include the existence of unhelpful stereotypes.[7,8]

Healthcare is a complex socio-technical system[9] (also referred to as a complex adaptive system) and as such has significant differences from the nuclear and airline industries. It is a complex and intricate system that requires both integration at the micro level (between professions and between departments) and adaptability. There is general agreement on what we want from a fully integrated healthcare system developed around the needs and safety of patients (right care, right time, with equity and efficiency). Simulation highlights redundancy as well as professional and system vulnerability. It allows us to aspire to more than just safety, using measures such as effectiveness, efficiency, equity, appropriateness, affordability and accessibility with real-time evaluation of processes and performance.

Our staff, our teams' SBL

SBL (Table 2) has gained significant recognition as an effective educational technique to be applied within the wider educational curricula for healthcare professionals.[10–12] SBL enables the practice of critical thinking and decision making in the healthcare setting, promoting logical, systemic and deliberate thinking while considering bias or assumptions.[12] It includes skills such as interpretation, analysis, evaluation, inference, explanation and self-regulation. Undergraduate and postgraduate specialities (emergency medicine, paediatrics, surgery and some surgical subspecialities, medicine and anaesthetics) require mandatory courses that are simulation based. Some require simulation as part of their regular curriculum as dictated by the individual colleges and a few use some form simulation in their qualification and exit exams.

With this plethora of simulation techniques available, it is important that educators have a strong grasp of how to maximise the efficiency and effectiveness of learning. They need to be expert "coaches" working within a well-defined educational framework, drawing insights from prior theorists to guide their practice.

Pre-registration (undergraduate)

There is an obvious role for SBL in undergraduate health professional education (including allied health, paramedic, nursing and medical) to efficiently enable the graduation of a technically competent practitioner with empathic

communication and teamwork skills. There is also evidence to suggest simulation can be used to substitute a proportion of mandated clinical placement hours in pre-registration nursing programmes without compromising patient outcomes.[13] Physiotherapy has also generated evidence supporting the substitution of clinical placements with SBL in Australia.[14] Clinical placements are a precious commodity and for students to fully leverage the potential opportunities, they should engage in simulation-based preparation. At a time of increasing pressure on clinical placements, it is important that students are adequately prepared to maximise their learning by practising technical and non-technical skills in simulation without risk to themselves or the patient. Well-conducted SBL with skilled debriefing can be utilised to scaffold students' learning in the most efficient and effective way. There is also the possibility that conventional training may not offer enough clinical contacts/situations to attain adequate competency in all clinical areas.[15] High-quality simulated experiences can also be used to upskill students to manage situations they may not commonly be exposed to in the clinical setting, such as managing deteriorating patients with complex decision making or leading a resuscitation. This training would be enhanced if it is interdisciplinary and can occur with investment in the existing simulation infrastructure.

Post-registration (postgraduate)

Post-registration simulation is vital for consolidating undergraduate learning and for orientating students into their professional roles. It can also serve as way to test, maintain and learn new skills. SBL provides staff with opportunities to practise and refine their clinical skills. It allows them to gain confidence in making rapid decisions, performing critical procedures and recognising and managing medical emergencies.

Simulated learning environments are also an ideal educational tool for the situated learning of professionalism as they involve both the observation of practice that can be controlled for specific environmental and psychosocial stressors and debriefing with an opportunity to view video recording of one's own behaviours and encourage reflection.[16] SBL allows staff to explore ethical and cultural dilemmas and challenging situations that may arise in clinical practice. It should create a psychologically safe space for students or staff to be vulnerable in their reflections on decision making, ethical reasoning and professional behaviour. By engaging in simulations, staff can effectively develop the necessary skills to navigate complex ethical and cultural issues and maintain professional standards.[17]

Table 2 demonstrates the inconsistency in New Zealand in the availability of simulation training in postgraduate practice. There are many reasons this may exist, such as availability of resources (time, space, equipment and expertise). Managers may lean towards clinical service demands over training responsibilities but they both are important. Clinicians are busy but like other professionals they need to be able to "practise or train" in their craft to strive for excellence. Te Whatu Ora needs to acknowledge this and make use of the existing simulation infrastructure to improve healthcare.

Communication, collaboration and culture

Simulation has a role in developing non-technical skills, which include those communication skills such as active listening, negotiation and de-escalation that are essential in healthcare. A high proportion of patient complaints to the Health and Disability Commissioner have poor communication at their core. Unfortunately, healthcare also continues to have concerns with episodes of incivility within and between professional groups;[18] this has the potential to impact on the provision of patient care as well as the mental and physical wellbeing of individual healthcare practitioners.[19] Interprofessional socialisation as a first step in developing collaboration is well known and can have a positive contribution to collaboration within healthcare.[20,21] IPE has been shown to improve performance, morale, satisfaction and ultimately outcomes.[22,23] SBL fosters interprofessional collaboration and communication among healthcare teams. It encourages staff to work effectively together, delegating tasks appropriately and communicating collaboratively in high-stress scenarios.

The Institute of Medicine strongly recommends that teams working together should train together and the argument for teamwork in healthcare has also been summarised in New Zealand literature.[7] Individual teaming skills, in conjunction with teamwork, have been extensively studied and should be applied to a wide range of healthcare activities that include ward rounds and meetings, as well as situations such as the deterio-

rating patient. These scenarios can be rehearsed in simulation and debriefed using skilled facilitators to enhance the effectiveness of teamwork in the real situations of healthcare. The ability to work effectively as a team is influenced by a variety of external factors including psychosocial factors such as culture and psychological safety.[24] The practise of effective teamwork requires working to a unified goal (shared mental model) as well as a core language of communication, effective leadership and a clear understanding of roles.[13,25] By practising teamwork in simulations and receiving feedback, staff can improve coordination, reduce errors and enhance patient safety.[26,27] Furthermore, simulation can be employed to both explore and teach cultural competency. Involving stakeholders in scenario designs can effectively address different cultural safety issues. Thus, simulation and provision of "safe" debriefing processes have the potential to breakdown cultural and equity barriers and teach and uphold the principles of Te Tiriti o Waitangi.[28]

Our healthcare system

Healthcare is a dynamically adaptable system. At any given moment, there are physical environments that are immediately familiar to long-serving staff but unfamiliar to recently employed staff. There will be IT programs and equipment that have been in use for some time and others that are being newly implemented, and a few patients that are known and familiar to staff but many for whom this is their first experience in a hospital environment. All of this contributes to the complexity of the healthcare role and the cognitive load for each individual healthcare worker. Embedding regular simulation practice constantly evaluates current and new processes to ensure they remain fit for purpose, and simulation can also be used to evaluate new physical spaces, IT programs, equipment and policies. The use of simulation at key stages of a new hospital build may also identify potential issues with physical spaces or process errors before they result in patient or staff harm; ideally, before any issues identified become irreversible without incurring significant financial cost or impacting patients. We are aware of some real examples within New Zealand (resolved after simulation) that included doors between theatres constantly cycling open because of the sensitivity of the infrared "no touch" access, and lack of signage for wayfinding in long similar-looking corridors delaying attendance of staff in emergencies and hindering their ability to rapidly locate equipment in a crisis. With current plans to rebuild many key tertiary centres throughout New Zealand, such as the Nelson and Dunedin hospitals, simulation could play a vital role in making sure these massive new projects are well designed, practical and well implemented.

The geography of Aotearoa can also lead to specific challenges in providing equitable care and telehealth is an expanding area that can be used both to provide support and to create simulation experiences from a distance. There have been recent developments in tele-simulation protocols fostered by the pandemic that may be applicable in the New Zealand context.[29]

Quality improvement and safety

Simulation techniques have been used throughout history to improve patient care and should be considered as instruments of quality improvement.[30] They allow healthcare workers to practise perfecting routine aspects of their roles, such as communicating with colleagues and patients in complex stressful situations as well as practising technical procedures. When simulated patient scenarios are conducted in the clinical environment, it is possible to identify "near misses". These risks can then be reported using a clear process, enabling them to be reviewed and managed appropriately. It is important to recognise that "work as imagined" is not always "work as done" and "work as done" processes should be continually evaluated. Many research projects have focussed on evaluating the impact of simulation to improve quality improvement processes and patient safety. Findings show that SBL enabled staff to identify and rectify errors within a controlled environment, allowing them to comprehend the consequences of their actions and learn from their mistakes. By addressing potential risks through simulation, staff can develop a proactive approach to risk management, ultimately reducing adverse events. This, in turn, can foster a culture of safety and improvement within healthcare.

There should be a close relationship between those responsible for developing healthcare environments, mapping processes, creating policies, staff wellness and SBL and those leading quality and patient safety at the governance level.[2] Human factors (defined as all those factors that influence people and their behaviour) is a

core component of quality and safety and simulation programs.[31]

Systems engineering and integration

Systems engineering, an interdisciplinary field of engineering, focusses on how complex projects should be designed and managed. Logistics, coordination of teams, modelling, automatic control of machinery and human factors become more challenging when dealing with complex and high-stakes healthcare provision. Systems integration refers to planned, collaborative, integrated and iterative application of SBL, assessment and research activities using systems engineering and risk management principles. The goals of systems integration include excellent bedside clinical care, enhanced patient safety and improved outcomes across the healthcare system. The process involves engaging all relevant stakeholders, including healthcare professionals, educators, administrators and patients, in the redesign process. Their input is crucial in understanding the current challenges and finding innovative solutions. An example of this simulation principle, clear in most healthcare practitioners' minds, is the effective and widespread of use of simulations to test systems and processes during COVID-19. The COVID-19 pandemic was a unique time, when physical environments, procedures and processes had to be modified rapidly to adapt and readapt to the evolving demands, all aimed at minimising risks to both and patients.

Simulation techniques can help implement a system for continuous improvement by regularly evaluating the effectiveness of redesigned processes and training programmes. They can also be used to explore the integration of technology, such as electronic health records, telemedicine and artificial intelligence, while keeping in mind human factors. It cannot be emphasised enough that the aim would be to enhance the efficiency and effectiveness of healthcare delivery while maintaining the wellbeing of healthcare employees, which would enable them to focus on patient care.

Limitations

Simulation is a versatile technique with broader applications in healthcare than some might imagine. However, it is not a silver bullet. It cannot address all healthcare challenges or completely replace every clinical experience. Embedding simulation wisely within healthcare is essential, as is recognising current constraints such as equipment availability, expertise, training, time, space, and service-related issues in our healthcare system.

Conclusion

Developing a national strategy for the implementation of simulation is of utmost importance. As our healthcare system is redesigned, simulation techniques need to be integral in ensuring that the redesign is fit for purpose. It must be understood that simulation goes beyond being merely an advanced educational tool. Simulation has a role in highlighting issues in current systems and processes as well as helping to develop and test new processes and systems. In the context of quality and safety, it's crucial to maximise the utilisation of simulation along with ergonomic designs to create an environment where healthcare staff find it difficult to make mistakes, rather than relying solely on human intervention to uphold a system that might be faltering. Te Whatu Ora and Te Aka Whai Ora should provide a sustainable and quality simulation agenda nationally and there needs to be resources set aside at both national and local levels. This means budgeting for simulation providers/educators, equipment and training facilities. It should be factored in (budgeted for) as part of core business, not just a "nice to have" provided by enthusiasts who often do it over and above their regular jobs. We suggest the formation of a national steering committee to do a more in-depth stocktake of simulation services and make recommendations of future directions.

As healthcare organisations continue to prioritise patient safety and staff competence, SBL should be considered an essential component of professional development programmes. The current shortage of healthcare providers is an area where simulation can offer significant benefits. In response to Te Whatu Ora's call for innovative clinical placement models, we would like to draw attention to SBL environments. Partial substitution of mandated clinical hours with SBL could be a potential solution.

Extensive and authentic organisational collaboration is a must among educational institutions, healthcare providers and regulatory bodies. In the evolving healthcare and education landscape, continuous improvement and

compliance with regulatory standards will be of paramount importance. The authors hope that this paper will draw attention to the existing simulation infrastructure and initiate a dialogue regarding the place of simulation techniques within the organisation. Finally, we hope that there will be an acknowledgement of the need of our healthcare staff for expert coaching, performance feedback and team training—just like the All Blacks.

Table 1: Te Whatu Ora simulation capabilities.

Hospital	Physical space	Dedicated sim FTE, #	Community outreach	Equipment	Activities	Funding staff	Funding equipment
North Island hospitals							
Whangārei	Y	None .5 fellow	Peripheral hospitals Medical centres Universities	Task trainers Paed low fidelity Adult low fidelity Adult high fidelity	Service specific Compliance training Response to adverse events Communication education Interprofes-sional training Quality improvement Systems Governance	None	Hospital
Auckland City	Y	7.0	Peripheral hospitals Medical centres	Task trainers Paed low fidelity Paed high fidelity Adult low fidelity Adult high fidelity	Service specific Compliance training Response to adverse events Communication education Interprofes-sional training Quality improvement Systems Governance	Hospital	Hospital Charities Course revenue Mixed
Waitematā Northshore **Waitakere**	N	None	None	Paed low fidelity Paed high fidelity Adult high fidelity	Service specific Response to adverse events Interprofes-sional training	Hospital	Hospital

Table 1 (continued): Te Whatu Ora simulation capabilities.

Starship	N	4.6	Peripheral hospitals Medical centres	Task trainers Paed low fidelity Paed high fidelity Adult high fidelity Augmented reality Virtual reality	Service specific Compliance training Response to adverse events Communication education Interprofessional training Research Quality improvement Systems Facilities design Governance	Charities	Charities
Middlemore	Y	3.8	Ambulance Te Pūkenga Universities Peripheral hospitals Medical centres	Task trainers Paed low fidelity Paed high fidelity Adult low fidelity Adult high fidelity	Service specific Compliance training Response to adverse events Interprofessional training Systems	Hospital Course revenue	Hospital Charities Course revenue
Tairāwhiti	N	None	University	Adult low fidelity Adult high fidelity	Service specific Compliance training Communication education Interprofessional training	Mixed	Mixed
Taranaki	Y	None	None	Paed low fidelity Adult low fidelity Adult high fidelity	Service specific Compliance training Response to adverse events Communication education	Hospital	Hospital

Table 1 (continued): Te Whatu Ora simulation capabilities.

Lakes	Y	None	Peripheral hospitals Medical centres	Task trainers Paed low fidelity Adult low fidelity Adult high fidelity	Service specific Compliance training Interprofes-sional training	Hospital Course revenue	Hospital Course revenue
Waikato	Y	2.75	Peripheral hospitals Medical centres	Task trainers Paed low fidelity Paed high fidelity Adult low fidelity Adult high fidelity	Service specific Compliance training Interprofes-sional training Quality improvement Systems	Hospital Course revenue	Hospital
MidCentral	Y	1	Peripheral hospitals Medical centres	Task trainers Paed low fidelity Paed high fidelity Adult low fidelity Adult high fidelity	Service specific Compliance training Response to adverse events Communication education Interprofes-sional training Research Quality improvement Systems Governance	Hospital Course revenue	Hospital Course revenue
Tauranga Whakatāne	Y	.6	University	Task trainers Paed low fidelity Adult low fidelity Adult high fidelity	Service specific Compliance training Response to adverse events Interprofes-sional training Quality improvement Communication education Systems	Hospital University	Hospital

Table 1 (continued): Te Whatu Ora simulation capabilities.

Whanganui	Y	None	Peripheral hospitals Medical centres	Task trainers Paed low fidelity Adult low fidelity Adult high fidelity	Service specific Compliance training Communication education Interprofessional training Systems	Hospital	Hospital
Wairarapa	N	None	None	Adult high fidelity	Service specific Interprofessional training	Hospital	Hospital
Capital, Coast and Hutt Valley	Y	11.1	Ambulance Te Pūkenga Universities Peripheral hospitals Medical centres International learner	Task trainers Paed low fidelity Paed high fidelity Adult low fidelity Adult high fidelity Augmented reality Virtual reality Moving/ handling Aeroplane simulator	Service specific Compliance training Response to adverse events Communication education Interprofessional training Research Quality improvement Systems Facilities design Governance	Hospital Course revenue	Hospital Charities
Hawke's Bay	Y	None	Peripheral hospitals Medical centres	Paed low fidelity Adult low fidelity	Service specific Compliance training Response to adverse events Communication education	Hospital	Hospital

Table 1 (continued): Te Whatu Ora simulation capabilities.

South Island hospitals							
Hospital	**Physical space**	**Dedicated sim FTE, #**	**Community outreach**	**Equipment**	**Activities**	**Funding staff**	**Funding equipment**
Nelson	N	.6	Peripheral hospitals Medical centres	Task trainers Prem infant low fidelity Paed high fidelity Adult low fidelity Adult high fidelity	Service specific Compliance training Response to adverse events Communication education Interprofes-sional training Quality improvement Systems	Hospital	Hospital Charities
Wairau Blenheim	N	None	None	Paed low fidelity Adult low fidelity	Service specific Compliance training	Hospital	Hospital
Greymouth Te Nīkau	N	.1	Ambulance	Paed low fidelity Adult low fidelity	Service specific Compliance training Interprofes-sional training Quality improvement Systems	Hospital	Hospital
Waitaha Canterbury	Y	1.5	Ambulance Te Pūkenga Universities Peripheral hospitals Medical centres	Task trainers Paed low fidelity Paed high fidelity Adult low fidelity Adult high fidelity Augmented reality Virtual reality	Service specific Compliance training Response to adverse events Communication education Interprofes-sional training Research Quality improvement	Hospital	Hospital

Table 1 (continued): Te Whatu Ora simulation capabilities.

				Locally developed	Systems Facilities design Governance Training equipment governance		
Queenstown	N	None	Universities Peripheral hospitals Medical centres	Task trainers Adult high fidelity	Service specific Interprofes-sional training	Hospital	Hospital
Dunedin	Y	2	Universities	Task trainers Paed high fidelity Adult low fidelity Adult high fidelity	Service specific Compliance training Response to adverse events Interprofes-sional training Quality improvement Systems Facilities design	Hospital	Hospital University
University of Otago Simulation Centre	Y	2.46	University	Task trainers Paed low fidelity Paed high fidelity Adult low fidelity Adult high fidelity	Service specific Compliance training Communication education Interprofes-sional training Research Facilities design	University	University Charities Course revenue

Table 1 (continued): Te Whatu Ora simulation capabilities.

Invercargill	Y	1	Te Pūkenga Universities Peripheral hospitals Medical centres	Task trainers Paed low fidelity Paed high fidelity Adult low fidelity Adult high fidelity Simulated monitors	Service specific Compliance training Response to adverse events Communication education Interprofes-sional training Research Quality improvement Systems Facilities design Governance Training equipment governance	Hospital	Hospital

Table 2: Types of SBL.

Tabletop exercises
Disaster and mass casualty exercises
Process mapping
Paper-based simulation exercises, escape rooms
Task trainers for learning specific technical skills
Airway heads
CPR trainers, AED trainers
IV and central venous access, interosseous
Urethral catheterisation
Lumbar puncture trainers
Ultrasound identification and procedure models (echocardiography, nerve blocks, access)
Chest drain models
Obstetric and gynaecological task trainers
Paracentesis trainers
Cricothyroidotomy trainers
Models with specific exam findings (prostate, testicle, breast, Mr Hurt, otoscopy)
Simulation manikins (high and low fidelity)
ALS trainers
Advanced simulators
Birthing manikins
Standardised patients
Animal procedure labs
Role-play
E-learning
Virtual reality
Augmented reality
Serious games
Hybrid combinations of any of the modalities

COMPETING INTERESTS
Nil.

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